

CLAIMS

1. A rare earth ion ultrashort laser source including on the one hand a resonant cavity (1) having a first output face (2) partially reflecting and a second reflecting face (3), and on the other hand a first active material (4), placed inside the resonant cavity, having a saturation fluency greater than 3 J/cm^2 and receiving a pump luminous flux (5), said flux being transmitted by a first solid laser pump source (7), said source transmitting luminous pulses having an energy E_L ,

10 characterised in that :

- the resonant cavity (1) exhibits a length of optical path travelled by said pulses greater than 7,5 m so that the pulsed energy E_L is greater than 100 nJ, said optical path including at least one passage in said active material (4),

- the ultrashort laser source comprises means for lengthening the resonant cavity (1) thereby enabling to extend the length of the optical path travelled by said luminous pulses in the resonant cavity (1) of a compact laser source, the ABCD propagation matrix of said resonant cavity (1) being close to the unit matrix so that the features of the luminous beam going back and forth in the resonant cavity (1) remain unchanged.

20 2. An ultrashort laser source according to claim 1, characterised in that the length of optical path ranges between 7.5 m and 300 m.

3. An ultrashort laser source according to claim 1 or 2, characterised in that the means for elongating the cavity include at least one device for elongating the cavity (8) including at a first end a first planar mirror (9) and at the other end a second planar mirror (10), said first and second planar mirrors (9, 10) being placed respectively at the respective focus of a first and second concave spherical mirrors (11, 12), said second planar mirror (10) having a normal axis at its surface tilted vertically by an angle θ/n with respect to a plane parallel to the plane containing the first planar mirror (9) so that a luminous pulse entering said device (8) under an angle of incidence θ in a vertical plane and under an angle Φ in a horizontal plane, with respect to the normal at the surface of the first planar mirror (9) is subjected to $n/2$ reflections on the second

spherical mirror (10) before exiting said device.

4. An ultrashort laser source according to claim 3, characterised in that an input mirror, situated at the front and spaced away from the first spherical mirror (11) enables injecting and ejecting luminous pulses in the device for
5 elongating the cavity.

5. An ultrashort laser source according to any claims 1 to 4, characterised in that the laser source comprises at least one second active material (5) placed inside the resonant cavity (1), said second active material (5) receiving a pump luminous flux (14).

10 6. An ultrashort laser source according to claim 5, characterised in that said pump luminous flux (14) is transmitted via a second solid laser pump source (15).

7. An ultrashort laser source according to any claims 1 to 6, characterised in that the number of passages in each active material (4,5) is
15 greater than or equal to 2.

8. An ultrashort laser source according to claim 7, characterised in that the number of passages in each active material (4, 5) is equal to 4.

9. An ultrashort laser source according to claim 7 or 8, characterised in that it comprises a dichroic mirror (13) placed between said active material (4,
20 5) and the corresponding solid laser pump source (7, 15), said mirror receiving the luminous pulses from said active material (4, 5) and reflecting said luminous pulses towards the active material (4, 5).

10. An ultrashort laser source according to any claims 1 to 9, characterised in that the solid laser pump source (15) is a semiconductive laser.

25 11. An ultrashort laser source according to any claims 1 to 10, characterised in that said active material (4, 5) comprises ytterbium ions.

12. An ultrashort laser source according to any claims 1 to 11, characterised in that said active material (4, 5) comprises neodymium ions.

13. An elongation device of a laser cavity defining an axis, characterised
30 in that it comprises two planar mirrors placed at the respective focus of two concave spherical mirrors, said focuses being on the axis of the cavity and one of the planar mirrors being tilted by an angle θ/n with respect to that axis.